PRODUCTION OF LOW COST COMPOSITE BASED IN ATIVATED CARBON FIBER PARTICULATES APPLIED IN RADIATION ABSORBING MATERIALS IN X BAND FREQUENCY

Ariane A. T. Souza[1]*, Janaína S. Oliveira[1], Braulio H. K. Lopes[1], Emersom S. Gonçalves[2], Jossano S. Marcuzzo[1], Sandro F. Quirino[1], Miguel A. Amaral Jr[1] and Mauricio R. Baldan[1]

[1] *Instituto Nacional de Pesquisas Espaciais – INPE*
[2] *Departamento de Ciência e Tecnologia Aeroespacial - DCTA*

1. Introduction

Nowadays, radiation absorber materials (RAM) have received great attention from the industries and academic research centers, due to their applications in the most diverse areas, such as military, aeronautics, aerospace and telecommunications [1]. In aeronautical and military areas the RAMs have been extensively studied in the frequency bands of 8-12 GHz, known as X-Band [2]. Materials such as carbon, ceramic oxides, ferromagnetic and conductive polymers are traditionally applied to RAM and are thus used as absorber centers of unwanted radiation [3]. In particular, carbon is traditionally applied as RAM in the GHz frequency band because it is an excellent reflector of electromagnetic radiation [4]. Therefore, many researchers on this frequency were carried out with carbon in its different allotropic forms such as: activated carbon fibers [5], carbon fiber felt screens with rectangular shapes [6], particulates dispersed in a matrix [7] and cobalt oxide deposit [8].

Therefore, in this study the main objective was to produce a composite based on carbon fiber (CF) and activated carbon fiber (ACF) particulates, which is able to attenuate electromagnetic radiation in the frequency range of 8-12GHz. In order to perform the measurements a guided wave method coupled to a vector network analyzer (VNA) was used. Besides, a structural characterization of the fibers was performed using a Raman spectroscopy technique, in order to verify possible defects in carbon structure of the fibers.

2. Experimental

Textile PAN was used to produce CF, due to its low cost compared with other raw materials. The carbonization was performed in argon atmosphere at a final temperature of 1000°C by using a heating rate of 30°C/min. complete the carbonization process. The process time at maximum temperature was set in 20 min to complete the carbonization process. After the carbonization, the activation of the fibers is performed using two activation methods, the physical and chemical activation. The physical activation was carry out at the temperature of 1000°C in carbon oxide atmosphere for 50 minutes. Already the chemical activation was performed in KOH solution, the FC was impregnated with a 6 molar KOH solution, and then was placed in the furnace in an argon atmosphere. The heating ramp was 5 °C/min until reaching 600°C and remained for 1 hour. After the production process of the materials, the samples were produced to perform the electromagnetic measurements in a VNA. The samples of CF, ACF and ACF by KOH etching were powdered, and separated into particulates size between 25-53μm. After that, the samples were employed in a paraffin matrix, with thicknesses of 1.5mm with dimensions of 10.16x22.86mm.

3. Results and Discussions

Through Raman spectroscopy it was possible to observe that the samples of CF and ACF presented disorganization in the graphite structure due to the presence of peak D in the spectrum (Figure 1). However, peak G showed greater intensity in both cases. Although the Raman spectra were similar, it was observed that the FWHM of the ACF samples decreased, which is related to the decrease in the presence of heteroatoms on the surface of the fiber due to activation process. This result influenced the reflectivity of the material, causing an attenuation of approximately 50% of the incident radiation in the ACF sample, as showed in Figure 2. However, the chemical activation with KOH in the CF sample did not show attenuation of the radiation.

*Corresponding author: "miguel.junior.mat@hotmail.com"

Fig. 1. *Raman spectra of CF and ACF*.

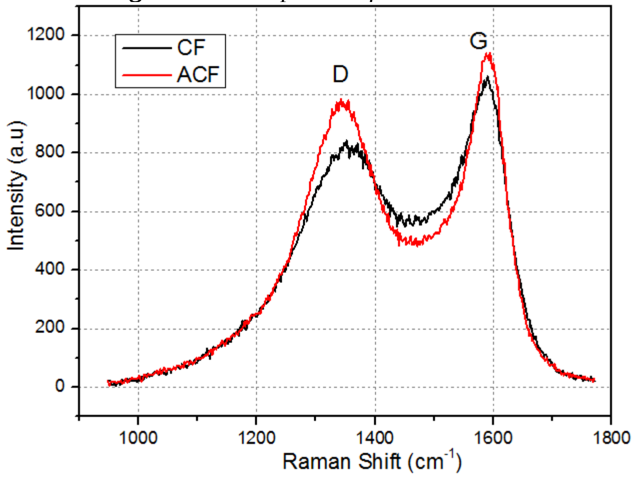
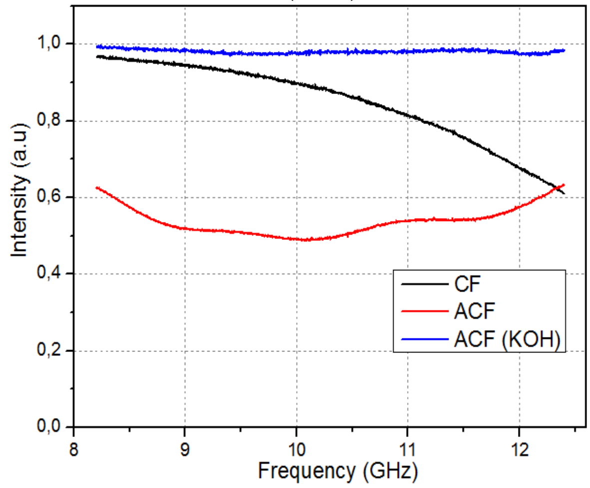


Fig. 2. *Reflectivity of the samples of CF, ACF and ACF (KOH)*



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*Corresponding author: "miguel.junior.mat@hotmail.com"